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ABSTRACT

This booklet provides a brief discussion of the anatomy and biology of rays in the Chesapeake Bay and a key to their identification. Descriptions of seven types of rays are also provided (with accompanying illustrations). These include electric rays, stingrays, butterfly rays, eagle rays, cownose rays, and manta rays. (JN)

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BIOLOGY and IDENTIFICATION of RAYS in the CHESAPEAKE BAY

by
Joseph W. Smith
and
J.V. Merriner, Ph.D.

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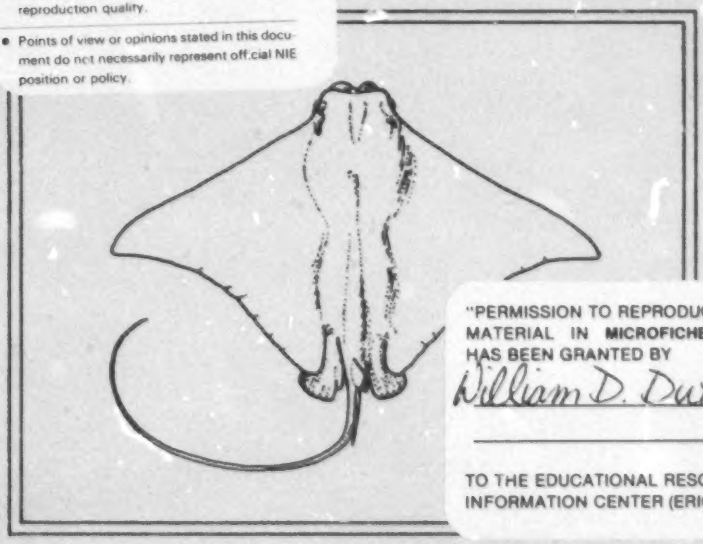

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Department of Ichthyology

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MARCH 1978

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The authors wish to thank Dr. Daniel Merriman of the Sears Foundation for Marine Research for his permission to use modified illustrations from Part Two of "Fishes of the Western North Atlantic" for the rays discussed in this publication. Our key was also adapted from this volume.

Finally, we thank Peggy Peoples for illustrating, and Ann Greer for editing and producing this publication.

J.W.S., J.V.M.

5A

ANATOMY AND BIOLOGY

Rays, along with sharks and skates, make up a group of fishes known as elasmobranchs. The skeleton of these fishes is composed entirely of cartilage. Most food and game fishes belong to the group called teleosts; that is, fishes possessing true bone. Many other differences are to be found between these two groups, but are beyond the scope of this publication.

Rays and skates may be thought of as sharks flattened from top to bottom (See Fig. 1). The pectoral fins are longer, wider, and more fleshy in rays than in sharks. They also serve as the primary means of locomotion, as opposed to use of the tail by sharks. The gill slits are positioned ventrally rather than on the sides of the body as in sharks. The mouth is also positioned ventrally.

The distinction between rays and skates is finer and they are often misidentified, as evidenced by the local names attributed to both groups throughout the Bay. Close inspection reveals several external differences. Skates possess two dorsal fins located near the tip of the tail; most rays have one or no dorsal fin. If two fins are present on a ray tail, the first is closer to the pelvic fins than the tip of the tail. Skates have a prepelvic spur and rays do not (See Fig. 2). The outer margins of the pelvic fins in skates are usually concave; in rays they are convex. Also, young skates develop outside the body of the female in a horny shell which is sometimes washed ashore on beaches and called a mermaid's purse; young rays develop inside the mother and are born as free-swimming individuals.

Except for the smooth butterfly ray and the Atlantic manta ray, all rays described in this publication possess a venomous spine or spines on the dorsal surface of their tails. The torpedo or electric ray has no stinger, but does possess electric organs capable of producing a shock.

Rays feed primarily on organisms which live on or in muddy and sandy bottoms. Ray teeth are adapted to crush or grind food items. Their diet consists of worms, shrimps, bivalve mollusks, snails, crabs, and small fishes. Flapping motions of the pectoral fins can be used to dislodge organisms from the bottom. Protrusion of the jaws also aides in the capture of prey. Contrary to popular belief, the sting is not used as an offensive weapon to spear potential prey.

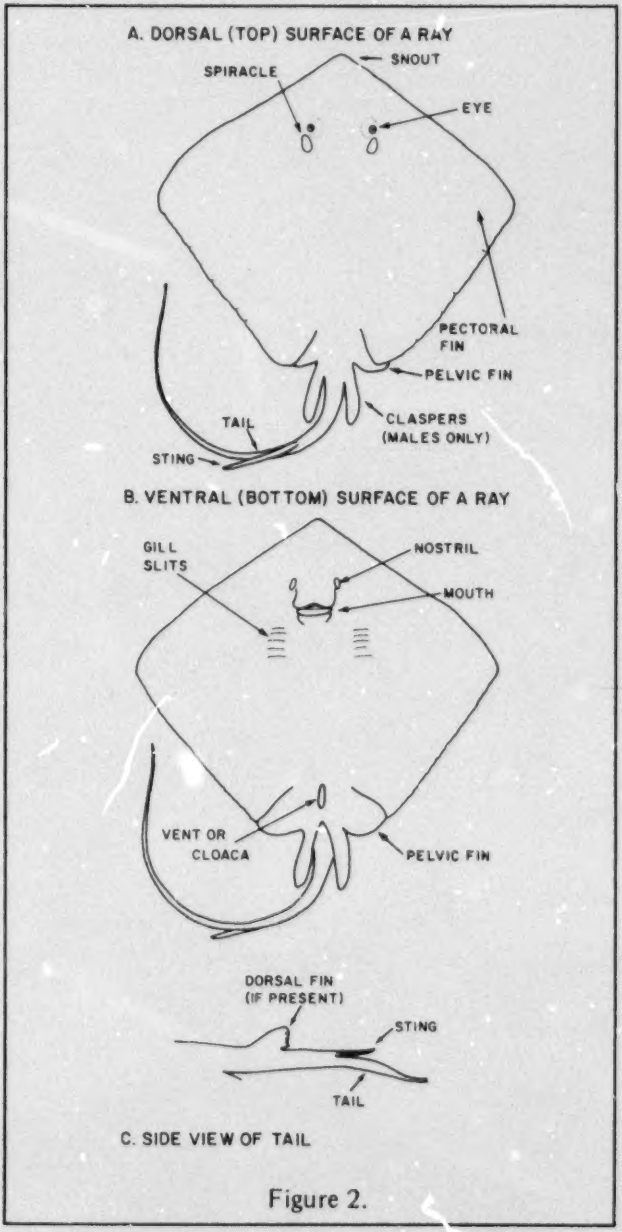
A. DORSAL (TOP) SURFACE OF A RAY
SPIRACLE
SNOUT
EYE
PECTORAL FIN
PELVIC FIN
CLASPERS (MALES ONLY)
TAIL
STING
B. VENTRAL (BOTTOM) SURFACE OF A RAY
GILL SLITS
NOSTRIL
MOUTH
VENT OR CLOACA
PELVIC FIN
DORSAL FIN (IF PRESENT)
STING
TAIL
C. SIDE VIEW OF TAIL

Figure 2.

Some rays, such as the dasyatids (stingrays), prefer to lie partially buried on the bottom with their eyes and spiracles protruding above the sands. The spiracles act as intake valves for water which is passed across the gills and out the ventral gill slits. Thus these rays can lie partially concealed on the bottom and breathe in relatively undisturbed waters. The position of the spiracles also allows intake of water with little gill-irritating sediment even while feeding.

Rays are ovoviviparous, that is, their young are nurtured inside the mother's womb and are born as miniature, free-swimming rays. However, there is no organ of attachment between mother and developing young. Embryos are believed to be nourished by milky secretions from the many fingerlike projections (villi) lining the uterine wall. The number of young varies from species to species but is usually 1-6. The "pups" are situated in the uterus with their wings folded upon themselves. Pups usually emerge tail first with the tail bent forward so as not to injure the mother with the sting.

Males differ externally from females by the presence of a round, almost clothespinlike appendage behind each pelvic fin (See Fig. 1). These structures, called claspers, are not solid tissue but rather are a rolled-up fin with a hollow groove running its length. During copulation sperm are transmitted to the female via these structures.

The entire tail of stingrays is not poisonous. The structure which inflicts wounds is a long, narrow spine (or sometimes spines) situated on the dorsal part of the tail. The spine is a hard, bonelike spike anchored firmly to the tail and terminating in a sharp point.

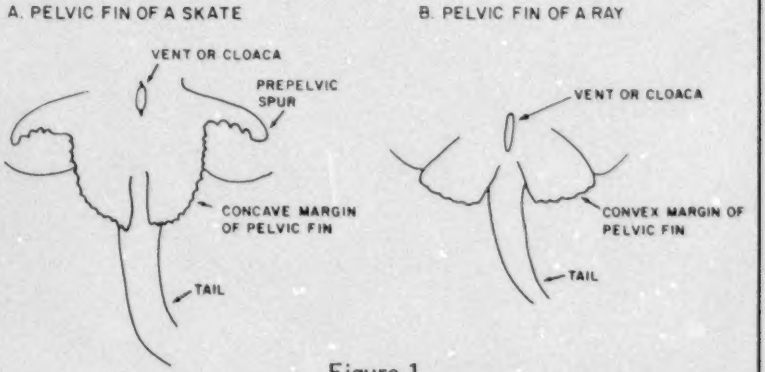

Figure 1.

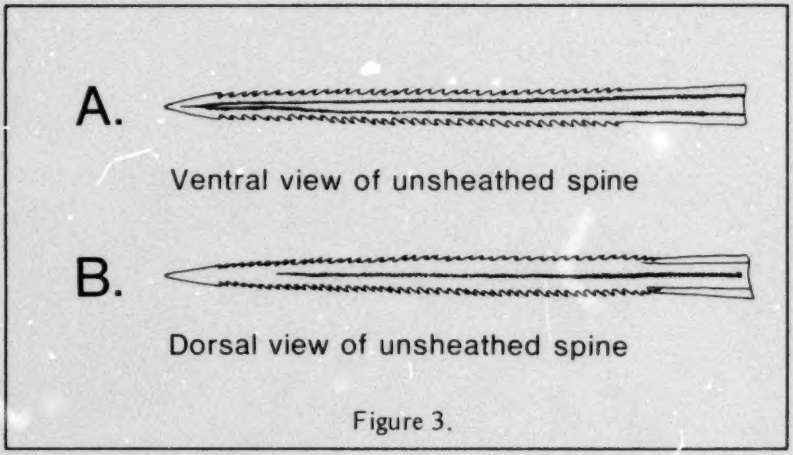

Figure 3.

Along both sides are many serrate edges or teeth which are recurved towards the base (See Fig. 3). The spine is enveloped in a sheath of skin, so the recurved teeth are evident only if part of the sheath has been removed by abrasion. Along the ventral side of the spine, two parallel grooves run from the base to tip. Contained within these grooves is a spongy material known as the venom gland, which is the major site of venom production. The sheath and area of the tail just below the spine are also thought to play a minor role in venom production. Thus, the spine is constantly bathed in a film of mucus and venom. The entire venom-producing apparatus, that is, the spine, sheath and venom glands is called the sting or stinger. There is no evidence to support the idea of an annual loss of stings, but occasionally two or more may be found overlapping each other on a tail.

The distance from the base of the tail to the sting's point of attachment on the tail varies among different families of rays. As this distance increases, the ray is able to arch its tail through a much larger radius. Thus, rays such as the dasyatids, with stings located further back on their tails, possess more efficient striking implements and can generate more power in a strike.

IDENTIFICATION OF RAYS

You can identify rays either by looking at the illustrations accompanying each species description or by following the key below. A key is a table of characteristics for a group of organisms arranged in couplets, one of which you choose. At the end of the chosen characteristic, you are directed to another couplet and again make a choice. The species is eventually reached. For example, a specimen is identified as the smooth butterfly ray, *Gymnura micrura,* by the choices of 1B, 3A, 4B, and 8B.

Every living organism is identified by a unique scientific name. Use of scientific nomenclature eliminates confusion caused when several common names are applied to an organism. For instance, the cownose ray, *Rhinoptera bonasus,* is called bullfish, cowfish, stinger, and skate throughout the Bay area.

TABLE 1. RAYS IN THE CHESAPEAKE BAY

Subclass Elasmobranchii	- Cartilaginous fishes
Order Batoidei	- Batoid fishes
Suborder Torpedinoidea	- Electric rays
Family Torpedinidae	- Electric rays
Topedo nobiliana	- Electric ray
Suborder Myliobatoidea	- Sting rays, Butterfly rays, Eagle rays, Cownose rays, Manta rays
Family Dasyatidae	- Sting rays
Dasyatis americana	- Southern stingray
Dasyatis centroura	- Roughtail stingray

Dasyatis sabina	- Atlantic stingray
Dasyatis say	- Bluntnose stingray
Family Gymnuridae	- Butterfly rays
Gymnura altavela	- Spiny butterfly ray
Gymnura micrura	- Smooth butterfly ray
Family Myliobatidae	- Eagle rays
Myliobatis freminvillii	- Eagle ray
Aetobatis narinari	- Spotted eagle ray
Family Rhinopteridae	- Cownose rays
Rhinoptera bonasus	- Cownose ray
Family Mobulidae	- Manta rays
Manta birostris	- Atlantic manta ray

KEY

1A Two well-developed dorsal fins. Go to 2

1B One or no dorsal fin. *(Suborder Myliobatoidea)*. Go to 3

2A Caudal tail fin well-developed; origin of first dorsal fin closer to pelvic fins than to tip of tail; anterior margin (snout) slightly concave; pectoral fins thick and fleshy, modified into electric organs. . . . . *Torpedo nobiliana*, Electric ray

2B Caudal fin absent or poorly developed; origin of first dorsal fin closer to tip of tail than to pelvic fins. These fish belong to the *Suborder Rajoidea* or skates and are not included in this publication.

3A Outer margins of the disc continuous; no separate anterior extensions of the head (fins or lobes); eyes and spiracles on top of the head. Go to 4

3B Anterior margins of the pectorals interrupted by a prominent head which is sharply marked off from the rest of the disc; eyes and spiracles on the sides of head. Go to 9

4A Disc width 1.3 times length of body or less; tail long and slender, its length from the center of the cloaca to the tip being longer than the disc. . . . . *Family Dasyatidae*, Stingrays. Go to 5

4B Disc width more than 1.5 times length of the body; tail short; distance from center of cloaca to tip of tail less than disc width. . . . . *Family Gymnuridae*, Butterfly rays. Go to 8

5A Outer corners of disc (tips of pectoral fins) broadly and evenly rounded. Go to 6

5B Outer corners of disc only narrowly rounded or abruptly subangular. Go to 7

6A Distance from snout to front of orbits (margin of the eye) equal to or shorter than distance between the spiracles; anterior margins of disc near snout slightly convex; dorsal and ventral caudal folds very large and black . . . . . *Daysatis say*, Bluntnose Stingray

6B Distance from snout to front of orbits longer than distance between spiracles; anterior margins of disc weakly concave; caudal folds small and grayish. . . . . *Dasyatis sabina*, Atlantic Stingray

7A Ventral caudal fold about as wide as height of tail; upper surface of tail with low longitudinal ridge posterior to spine; sides of tail without conspicuous "thorns". . . . . *Dasyatis americana*, Southern Stingray

7B Ventral caudal fold only about half as wide as height of tail; upper suface of tail posterior to spine rounded without longitudinal ridge; sides of tail in half grown specimens and larger with conspicuous "thorns". . . . . *Dasyatis centroura*, Roughtail Stingray

8A Posterior edge of spiracles with slender, tenaclelike appendage; tail armed with spine or spines. . . . . *Gymnura altavela*, Spiny butterfly ray

8B Posterior edge of spiracles without tenaclelike appendage; tail without spines . . . . . *Gymnura micrura*, Smooth butterfly ray

9A Anterior and subdivisions of pectoral fins form a thin flexible fin projecting forward from side of the head; mouth extending across the front of the head. *Manta birostris*, Atlantic manta ray

9B Anterior subdivisions of pectoral form one or two soft fleshy lobes extending forward below the front of the head; teeth pavementlike. Go to 10

10A Snout with conspicuous indentation along anterior margin; two soft fleshy lobes below snout. *Rhinoptera bonasus*, Cownose ray

10B Snout round; one fleshy lobe extending below and in front of head. . . . . *Family Myliobatidae*, Eagle rays

11A Color of upper surface dark with conspicuous pale round spots; teeth in a single series across in each jaw . . . . . *Aetobatis narinari*, Spotted Eagle ray

11B Color above uniform, dusky brown; teeth in a series of seven across each jaw. . . . . *Myliobatis freminvillii*, Eagle ray

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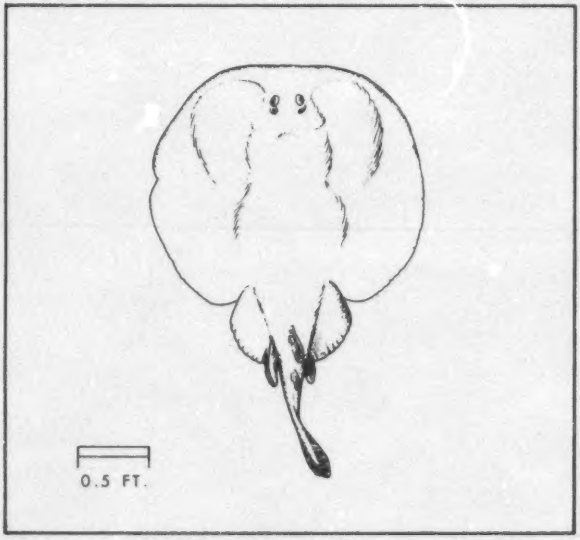
FAMILY TORPEDINIDAE - Torpedo Rays; Electric Rays

The members of this family have no sting on the tail, but do possess shock-producing organs. Their discs are well rounded, with fleshy pectoral fins. Only one species frequents the Chesapeake Bay.



Torpedo nobiliana - Atlantic Torpedo ray

The torpedo is the only ray discussed in this publication which has two dorsal fins and a well-developed caudal fin. The disc is broadly rounded with a nearly straight anterior margin. The dorsal surface is brown with white below. The largest individual on record measured about 5 feet across. The larger specimens may weigh 100-200 pounds. This ray is most abundant in Cape Cod and Rhode Island, with Cape Hatteras, N.C., as its southern limit. They are caught inshore from May to November, although most of the population is probably located offshore. Hence, the torpedo ray is a rare visitor to the mouth of the Bay.

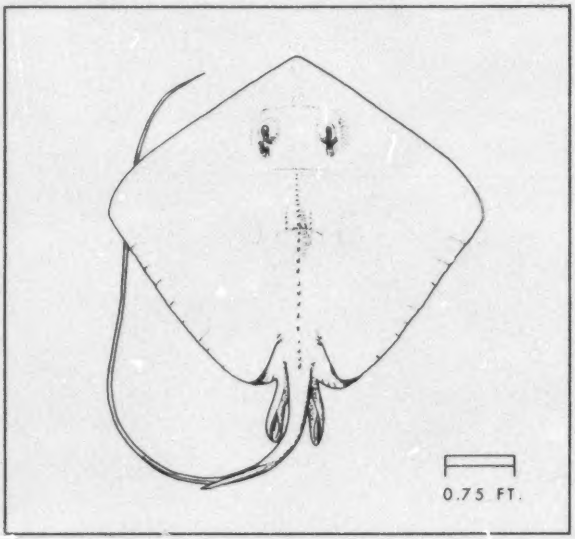
One shock-producing organ is located in each pectoral fin. They are situated anteriorly between the eye and outer margin of the fin, extending posteriorly to the mid-dorsal region. Their outline can sometimes be seen on the ventral surface. Within each organ are

cells which can produce an electric current; they are arranged in columns from the dorsal to ventral surface, like batteries placed in series. The torpedo is believed to lie partially buried on the bottom and discharge a current capable of stunning prey that swim overhead.

Small specimens are said to deliver a shock which causes a numbness to man's extremities, while shock from a large specimen may knock a person down.

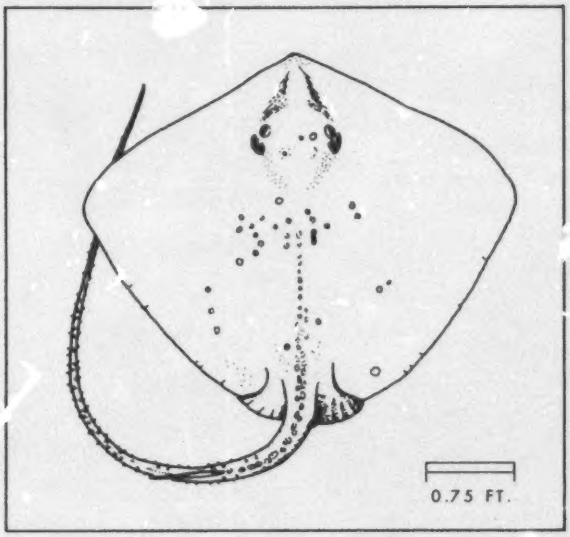
FAMILY DASYATIDAE - Stingrays; Stingarees

Members of this family have diamond-shaped bodies with long slender tails. They are generally found partially buried on the bottom with their eyes and spiracles above the sand, but they are sometimes found near the surface. They move by undulating movements of the edges of the pectoral fins.



Dasyatis americana - Southern Stingray

The southern stingray ranges from Brazil to New Jersey and reaches the northern limit only during summer. It is occasionally caught in the lower Chesapeake Bay from July to October in near-shore waters. It has been reported to feed on crabs, clams, shrimp, worms, and small fishes. Its dorsal surface varies from brown to grey or olive green with a white ventral surface. Occasionally a small gray or whitish spot can be detected in front of the eyes. The largest size reported for this species was 60 inches across the disc and was taken in the Bahamas.

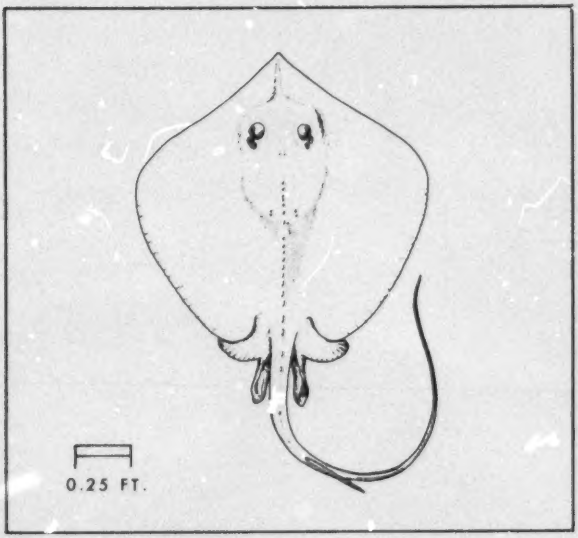


Dasyatis centroura - Roughtail Stingray

Except for the Atlantic manta ray, this is probably the largest ray to frequent the lower Chesapeake Bay. While in the Bay the roughtail stingray inhabits deeper waters. An 82-inch-wide specimen probably weighing about 800 pounds taken in the Gulf of Mexico is the largest roughtail recorded. Half-grown or larger specimens are particularly conspicuous because of the large "thorns" or "bucklers" on the sides of its tail.

During summer, roughtails appear to be more abundant in the northern part of their range, Cape Cod to New Jersey. With the onset of colder temperatures, these rays migrate south to winter below Cape Hatteras off the coast of the Carolinas and in the offshore waters of Florida.

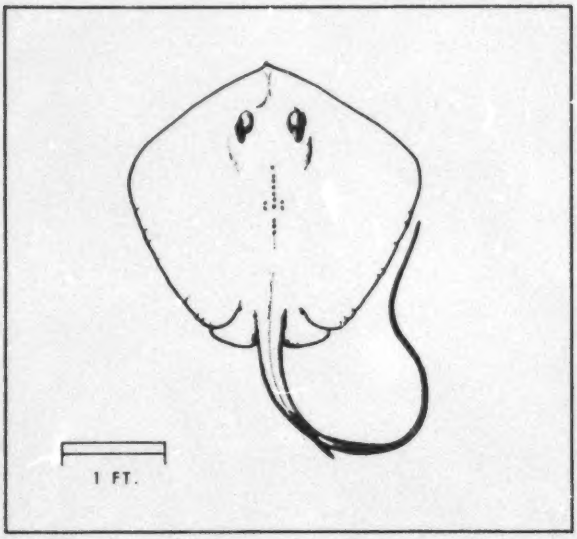
The young are born in fall and early winter and usually number about five per litter. This species appears to prefer crustaceans, with small fishes and worms playing minor role in their diet.



Dasyatis sabina - Atlantic Stingray

The Chesapeake Bay appears to be the northernmost extent of the Atlantic Stingray's range. It inhabits the areas from July through October. Coloration is usually yellowish-brown on top with white ventral side. It is usually found in water no more than 10 feet deep. This ray has been reported to feed on small crustaceans, worms, and amphipods.

This species is the smallest of the dasyatid rays found in the Bay. The largest recorded specimen measured 24 inches disc width.

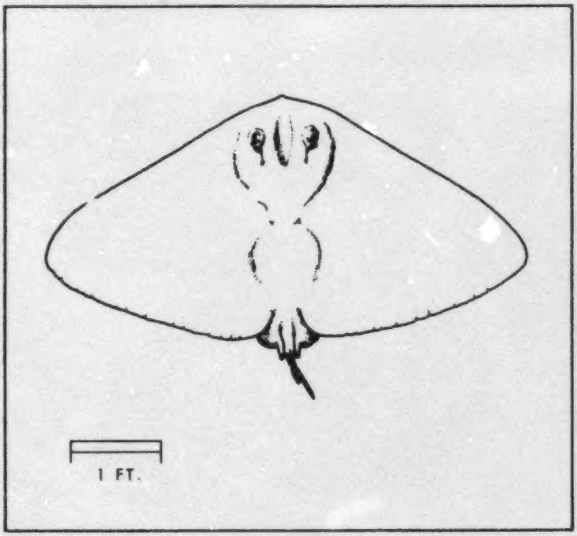


Dasyatis say - Bluntnose Stingray

The bluntnose stingray is the most abundant dasyatid ray to enter the Bay. Dorsal color of adults ranges from gray to red-brown, and ventral color is white. Maximum size has been reported as 36 inches across. This ray is commonly taken June through October from the shoreline to the deep channels. At the onset of colder autumn water temperatures they appear to migrate south along the North Carolina coast. Small crustaceans and worms may be their most important food items, with small bivalves and fishes taken in less quantity. The young of this ray are born during the latter part of the summer.

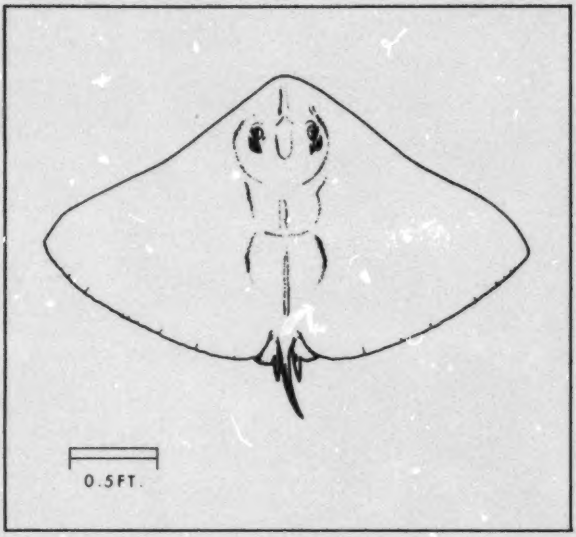
FAMILY GYMNURIDAE - Butterfly Rays

Rays of this family are easily recognized by their broad wings and relatively short tail. Their disc widths are 1.5 or more times the length of the body. Butterfly rays are often seen cruising over tidal flats during high tide.



Gymnura altavela - Spiny Butterfly Ray; Sand Skate

This is the largest of the two species of butterfly rays to enter the Bay. The dorsal surface is usually brown to gray with numerous pale blotches or spots. The ventral surface is white. The largest specimen recorded was taken off North Carolina and measured nearly 7 feet across. A 6-foot butterfly ray may weigh over 100 pounds. At one time the wings of this ray were sectioned and used as bait by some commercial crabbers in Virginia.

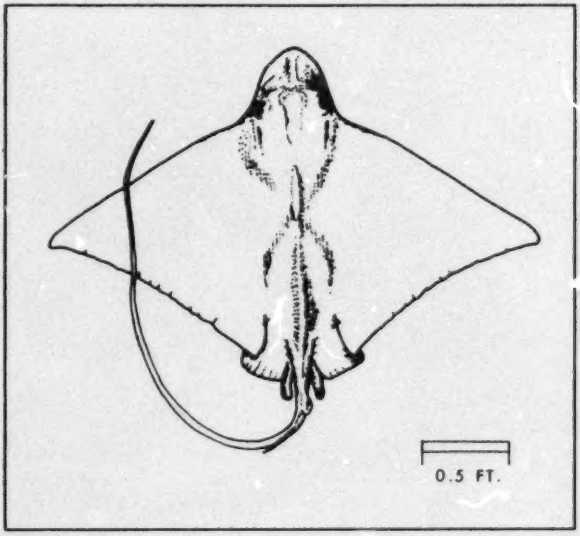


Gymnura micrura - Smooth or Lesser Butterfly Ray; Sand Skate

Like its large relative, the smooth butterfly ray is an occasional visitor to the lower Chesapeake Bay during summer. Unlike the spiny ray, however, the smooth butterfly ray does not possess a sting on its tail and therefore is quite harmless. It seems to prefer sandy bottoms, hence the common name Sand Skate. The largest specimen recorded from the Chesapeake Bay measured about 34 inches across the disc. Food items include small bivalves, crustaceans, and small fishes. This ray gives birth to its young during the summer months.

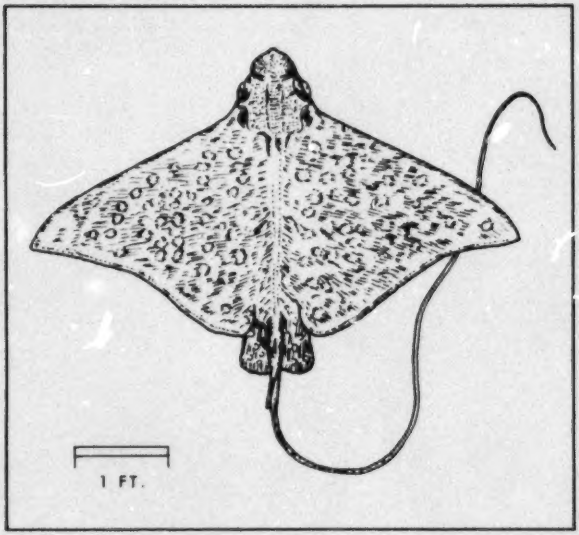
FAMILY MYLIOBATIDAE - Eagle Rays

The heads of members of this family are noticeably distinct from the rest of the body. Eyes and spiracles are on the sides of the head rather than the top. The tail is long and slender with one or several stings. A fleshy upper lip protrudes forward from the head. The mouth possesses pavementlike teeth in each jaw. The eagle rays progress through the water by flapping their pectoral fins; they seem to fly through the water rather than swim.



Myliobatis freminvillii - Bullnose Ray; Eagle Ray

The dorsal surface of the eagle ray is usually chocolate to red brown; the ventral surface is white. It is an occasional visitor to the lower Chesapeake Bay from May to October, and gives birth to its young during this period. The largest individual on record from the Bay measured 34 inches across. The eagle ray is usually found in water 10 to 15 feet deep over silty or silty-sand bottoms. Its diet consists primarily of snails, large crustaceans, hard-shelled bivalves, and small fishes. Its teeth are in a series of seven across each jaw. Due to this species' feeding habits and size it may have a negative impact on crustaceans and shellfish of the Bay.

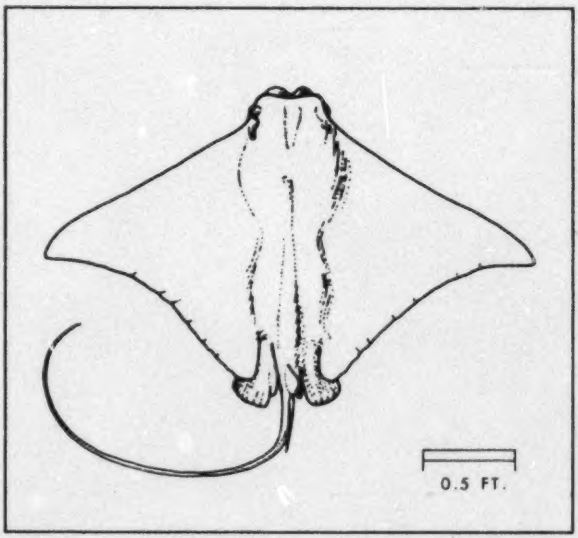


Aetobatis narinari - Spotted Duck-billed; Spotted Eagle Ray

Fresh specimens of this species are easily recognized by round, ring-shaped or sometimes elliptical white spots on a dorsal surface of black or dark brown. The teeth in each jaw are in a single series. This ray has not been reported in the Chesapeake Bay recently; however, it may stray into the Bay during the warmer months since its northernmost range limit is reported as being North Carolina. Movements of this ray are closely aligned to the coastline. They are usually sighted in schools of 5-10 to several hundred. The spotted eagle ray feeds primarily on clams and oysters.

FAMILY RHINOPTERIDAE - Cownose Rays

This family of rays is represented by one species along the east coast of North America. Like the eagle rays, its head is distinctly set off from the rest of the body. There is a well-defined indentation along the anterior contour of the head. Also, two fleshy subrostral fins are present below the head. Cownose, like the eagle rays, appear to gracefully fly through the water.



Rhinoptera bonasus - Cownose Ray

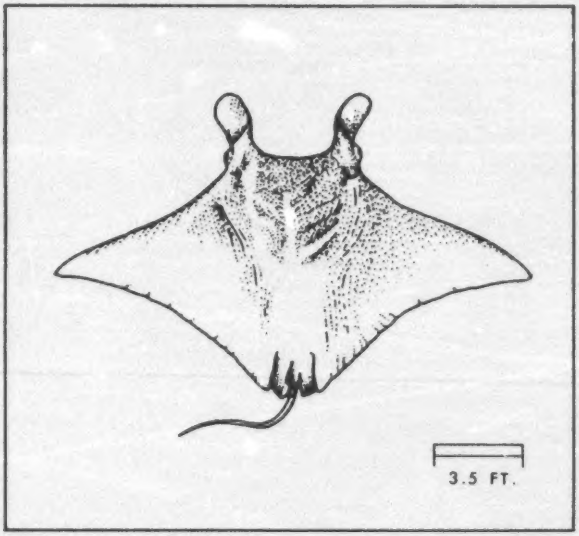
Cownose rays are light to dark brown dorsally and white below. They are a highly migratory species and occur in the Bay from May to October. At the onset of colder fall temperatures they follow the North Carolina coastline south. They are usually observed near the surface in schools of 5-10 to several hundred. Often the tips of their wings break water, resulting in the report of sharks. Their young are born shortly after arrival in the Bay and average 12 inches across. The largest adult specimens may reach 45 inches across and weigh more than 50 pounds. There are, however, several unconfirmed reports of larger individuals.

Schools of rays are usually observed feeding in shallow water during high tide. They prey primarily on hard- and soft-shell bivalves,

preferably oysters and clams, which they crush between pavement-like teeth with powerful jaws. In recent years commercial fishermen and shellfish growers have reported an increased abundance of this species. Their large numbers and peculiar feeding habits have recently combined to have a detrimental impact on commercial shellfish production in the Bay.

FAMILY MOBULIDAE - Mantas; Devilfishes; Devil Rays

Despite their forboding titles and enormous size the manta rays are relatively harmless. The common names appear to have resulted from the resemblance of the two protruding cephalic fins to devil's horns.



Manta birostris - Atlantic Manta Ray; Giant Devil Ray

The manta is by far the largest of all rays to frequent the Bay. They are extremely rare visitors and have been sighted or captured only near the mouth of the Bay and along the ocean side of the Eastern Shore. Specimens of 20 feet or more across and weighing upwards of 2,000 pounds have been recorded during the summer months along the east coast of the United States.

Mantas feed primarily on schools of small fishes or shrimps as they swim through the water. The two large cephalic fins protruding from the front of the head are believed to be used for directing and funneling food into their spacious mouths. Straining structures around the gills allow water to leave the mouth cavity, thus efficiently filtering food for digestion.

WANT TO KNOW MORE ABOUT RAYS?

WE SUGGEST.....

Fishes of the Western North Atlantic, Part Two
by H. B. Bigelow and W. C. Schroeder
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